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Field Sampling Plan for the Source Removal at Trenches T-3 and T-4 IHSSs 110 and 111.1

RMRS Rocky Mountain Remediation Services, L.L.C.
...protecting the environment

Environmental Restoration
Rocky Flats Environmental Technology Site

DOCUMENT CLASSIFICATION
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ACRONYMS

ASTM	American Society for Testing Materials
BFB	Bromofluorobenzene
CCR	Colorado Code of Regulations
CLP	Contract Lab Program
COC	Chain of Custody
EPA	Environmental Protection Agency
EMD	Environmental Management Department
DCA	Dichloroethane
DCE	Dichloroethene
FIDLER	Field Instrument for the Detection of Low Energy Radiation
FSP	Field Sampling Plan
Hcl	Hydrochloric acid
HPGE	High Purity Germanium Spectroscopy
IHSS	Individual Hazardous Substance Site
MCLs	Maximum Concentration Levels
OU	Operable Unit
PAM	Proposed Action Memorandum
PCE	Tetrachloroethene
PPRGs	Programmatic Preliminary Remediation Goals
PQLs	Practical Quantitation Limits
QA	Quality Assurance
QC	Quality Control
RFCA	Rocky Flats Cleanup Agreement
RFEDS	Rocky Flats Environmental Database System
RFETS	Rocky Flats Environmental Technology Site
ROI	Radiological Operating Instruction
SOPs	Standard Operating Procedures
SOW	Statement of Work
TCA	Trichloroethane

TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TDU	Thermal Desorption Unit
TICs	Tentatively Identified Compounds
UCLs	Upper Confidence Limits
VOA	Volatile Organic Analysis
VOCs	Volatile Organic Compounds
yd^3	Cubic Yard

LIST OF STANDARD OPERATING PROCEDURES (SOPs)

IDENTIFICATION NUMBER:	PROCEDURE TITLE:
5-21000-OPS-FO.03	*General Equipment Decontamination*
5-21000-OPS-FO.13	*Containerization, Preserving, Handling and Shipping of Soil and Water Samples*
5-21000-OPS-FO.14	*Field Data Management*

FO = Environmental Management Division (EMD) Operating Procedures Volume I Field Operations

1.0 INTRODUCTION

This Field Sampling Plan (FSP) supports the Source Removal at Trenches T-3 and T-4, Individual Hazardous Substance Sites (IHSSs) 110 and 111.1, at the Rocky Flats Environmental Technology Site (RFETS), which are contributing to the degradation of groundwater in the area. This FSP meets the requirements of a sampling and analysis plan. This source removal project is described in the Proposed Action Memorandum (PAM) for the Source Removal at Trenches T-3 and T-4, including details on project scope, contamination levels, and regulatory concerns. Information presented in this FSP is intended to be brief and provide the information necessary to understand the sampling approach for the project.

Based on historical aerial photographs and records, Trench T-3, (IHSS 110), is approximately 134 feet long, 20 feet wide, and 10 feet deep. The trench was used from approximately October 1964 through April 1966. Trench T-4, (IHSS 111.1), is approximately 125 feet long, 20 feet wide, and 10 feet deep. The trench was used from approximately April 1966 through April 1967. Both trenches were used to dispose of sanitary sewage sludge contaminated with uranium and plutonium. Crushed drums also contaminated with uranium and plutonium were disposed in the trenches. There are no reports of metallic nuclear materials deliberately buried in the trenches. Furthermore, analysis of characterization soil samples indicates radionuclide concentrations are below the action levels currently being developed by the Rocky Flats Cleanup Agreement (RFCA) Working Group and are, therefore, not a factor in the need for a source removal at these trenches. Tables summarizing the existing data for the trenches are given in Appendix 1.

Groundwater samples were taken from wells up-gradient (24393, 25093, and 3091) and down-gradient (24193, 24993, and 3687) of the trenches. The results of these analyses are summarized in Table 1-1 and indicate an increase in volatile organic compounds (VOCs) in the groundwater after passing under the trenches. Radionuclide contamination was not detected at significant levels in the groundwater samples.

The proposed action entails excavating VOC-contaminated soil and material from Trenches T-3 and T-4 and processing the excavated material to remove the VOCs using thermal desorption. The project will be a source removal to prevent further degradation of the surrounding soils and groundwater. The trench boundaries, as shown in Figures 1 and 2, will be staked prior to excavation, and the material within the trench boundaries will be excavated. Sampling and analysis will be used to ascertain which soils need to be removed that may extend beyond the boundaries of the trenches. The concentration of VOCs in the soils will be compared with the soil cleanup standards developed for RFETS and identified in the PAM. Following verification that the thermal desorption unit (TDU) has removed the VOC contamination, the trenches will be backfilled with treated soils and the area will be re-vegetated to return the trenches to a comparable undisturbed condition.

TABLE 1-1 T-3 AND T-4 GROUNDWATER SAMPLING RESULTS SUMMARY

	Maximum Concentrations (μg/l)							
	Upgradient Wells				Downgradient Wells			Federal Drinking Water MCLs
Contaminant	T-3 24393	T-3 12191	T-3 2991	T-4 3091	T-3 24993	T-4 3687	T-4 12691	
Carbon tetrachloride	240	180	560	450	4,100	3,673	4,500	5
Tetrachloroethene	250	200	140	39	1,600	4,654	1,000	5
Trichloroethene	40	40	66	51	110	221,860	560	5
Toluene	5	10	2	8	30	3,100	25.3	1,000

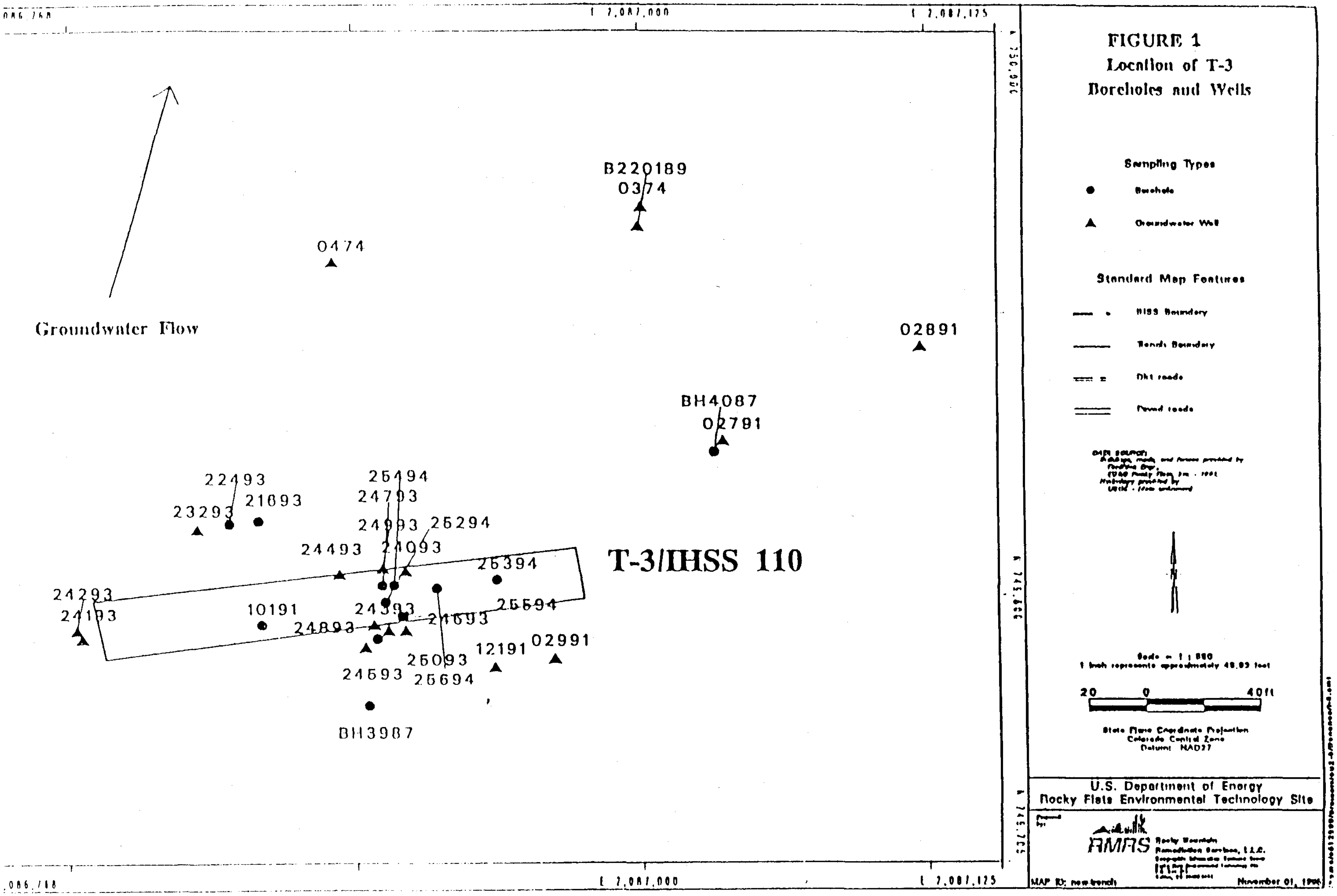
FIGURE 1
Location of T-3
Boreholes and Wells
Sampling Types
Borehole
Groundwater Well
Standard Map Features
IHSS Boundary
Trench Boundary
Dirt roads
Paved roads
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
RMRS
Rocky Mountain Remediation Services, L.L.C.
November 01, 1996
T-3/IHSS 110
Groundwater Flow
B220189
0374
0474
02891
BH4087
02781
22493
21693
23293
25494
24793
24993
25294
24493
24093
25394
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40ft

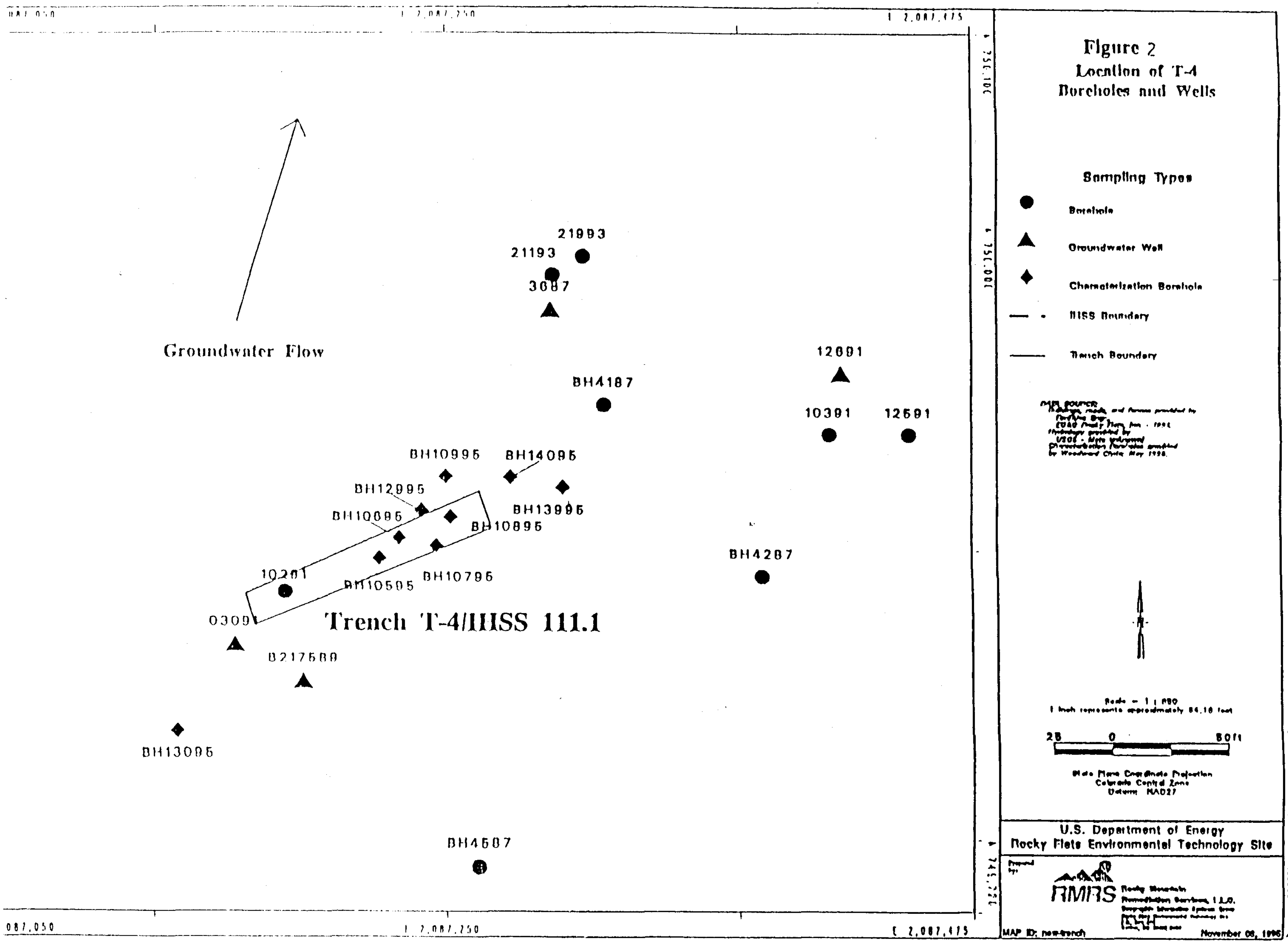


Figure 2
Location of T-4
Boreholes and Wells

2.0 SAMPLING AND DATA QUALITY OBJECTIVES

The purpose of this sampling effort is multi-fold and is described below:

- Samples will be collected to evaluate/verify that excavation cleanup standards stated in the PAM are met. These samples may also be used to document the conditions remaining in the excavation for a future RFETS Site-wide Risk Assessment and to supply data for evaluating any future impacts on groundwater from the remaining soils in the trenches.
- Samples will be collected to evaluate/verify that post-processing performance standards stated in the PAM are met. These samples may also be used to document the concentration of VOCs in soils returned to the trench after processing.
- Samples will be collected to verify existing radiological data from soils within the trenches, and to confirm the determination that these soils can be returned to the trenches.
- Samples will be collected to support various waste classifications and determinations for off-site shipment of debris.

After excavation, samples will be collected along the base and sides of the excavations and analyzed using a screening technique (described in Appendix 2) for the contaminants of concern (all VOCs) to establish the post-action condition of the trenches. The screening technique was developed such that the action levels required by the PAM are within the linear range of the calibration of the screening equipment, a gas chromatograph/mass spectrometer. Excavation will continue until excavation boundary sample results are below the excavation cleanup standards specified in the PAM or until groundwater or bedrock is encountered, or the limits of the excavation equipment are reached.

Following processing through the TDU, treated soils will be sampled and tested for process verification using the screening technique for VOCs to verify compliance with the performance standards stated in the PAM. The sampling frequency used for this verification is described in Section 3.2, and the statistical analysis supporting the sampling frequency is given in Appendix 3. Since the existing characterization data indicates that metals and semivolatile organics are not a concern in the trenches, no further analyses will be done for those constituents.

An extensive amount of sampling data has been collected regarding radiological contamination in the trench soils. Data collected to date indicate very low levels of radiological contamination within the trenches. However, because of uncertainties associated with potential contamination from debris, additional radiological screening and sampling will be conducted to further evaluate soils prior to replacement back in the trenches. Only those treated soils that are at or below the agreed-on replacement levels for radionuclides (put-back levels) for subsurface soils will be returned to the trench. These action levels are currently being developed by the RFCA Working Group and will be available for use by the project this summer. The logic behind the statistical evaluation of radionuclides is described in Appendix 4 of this FSP.

If large volumes of debris are encountered that do not appear to be contaminated with VOCs (e.g., are not covered with oils), it may be prudent to sample and evaluate this material so that uncontaminated materials are not unnecessarily treated in the TDU. This evaluation will include an initial visual and field screening evaluation, followed by confirmatory sampling. The approach to this is detailed in Section 3, and was developed to support the off-site disposal of radiologically contaminated debris.

Sampling efforts will be conducted according to the *Rocky Mountain Remediation Services, Quality Assurance Program Plan.* The screening technique (method) used for most of the VOC evaluation for the project is detailed in Appendix 2 and was derived from SW-846 Methods 8240, 8260 and the Contract Laboratory Program (CLP) Statement of Work (SOW). Due to the rapid turn-around time requirements for VOC analysis, the number of samples required for this project, and the cost of laboratory analysis using control samples and preparation of full CLP data packages, a high quality screening technique has been chosen for the majority of VOC analyses.

Data Quality Objectives allow samples to be analyzed at levels comparable to the action levels required for the project (see Appendix 2). Low detection limits are not required for this project, and would prohibit the rapid analysis required to evaluate soil treatment. Split samples, analyzed using SW-846 Method 8240 or 8260, will be sent to an independent off-site laboratory for verification of the screening results. However, screening results will be used to make decisions in the field and will be of sufficient quality to calculate residual risks posed by the soils left in place, and to determine if contaminant levels in treated soils are below performance standards prior to replacing the soils back in the excavation.

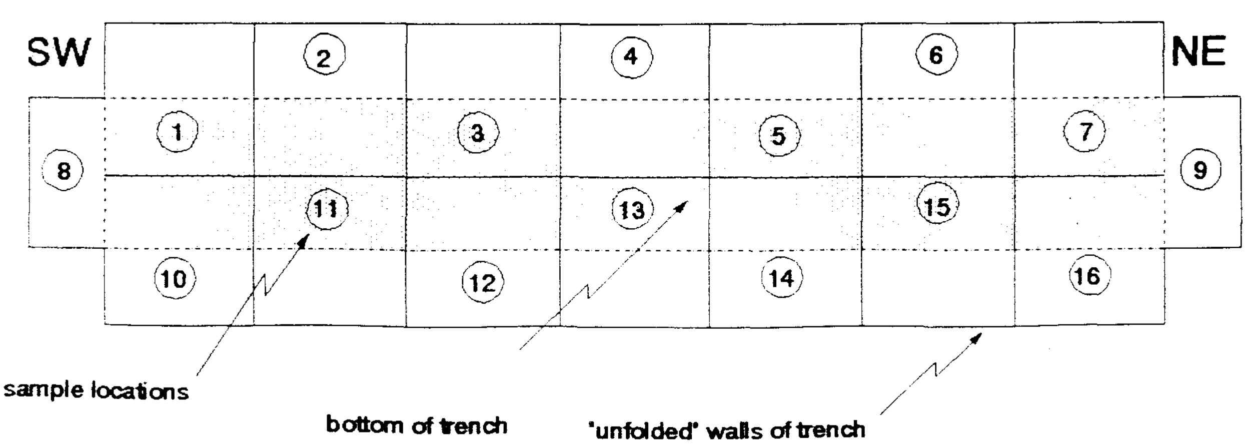
3.0 SAMPLE COLLECTION AND ANALYSIS

A number of different sampling events will be conducted to support this project. These events include excavation boundary soil sampling for VOCs, post-process soil sampling for VOCs, radiological verification sampling of the treated soil and sampling to determine if some of the debris within the trenches requires treatment. The sampling scheme for each type of event is described in the following sections.

3.1 EXCAVATION BOUNDARY SAMPLING

In order to determine the number of samples required in each trench to evaluate attainment of excavation performance standards specified in the PAM, the suggested guidelines from *Soil Sampling Quality Assurance User's Guide* published by the U.S. Environmental Protection Agency were used. The number of samples required in each trench is 16. The perimeter of the grid boundaries will be staked prior to sampling. Trench-3 is approximately 134 feet long, while Trench-4 is approximately 125 feet long. The trenches will be divided into approximately seven, equal-length sections along the bottom axis of each trench. As an example, this would allow for a 19-foot lengthwise grid dimension along the axes of Trench-3 and an 18-foot lengthwise dimension along the axes of Trench-4. The grid dimensions are dependent upon the final excavation, and the actual grid dimensions will be described in the field logbook. Individual grids will represent approximately equal areas. However, the two grid locations representing only the sidewalls of the trench (grids 8 and 9) will be made up of smaller areas because they lack a trench bottom component. The grid layout will be oriented so that grid 8 represents the western portion of the trench, while grid 9 represents the eastern portion of the trench (see Figure 3-1).

FIGURE 3-1 T-3 AND T-4 EXCAVATION BOTTOM SAMPLING SCHEME



After the limits of the excavation are reached, or field screening described in the Field Implementation Plan indicates that VOCs have been excavated from the trench soils, then the excavation boundary sampling described in this section will begin. One sample will be collected from each grid area specified in Figure 3-1 during the excavation boundary sampling. Grids represented by odd numbers will have samples collected from the center of the bottom portion of grid. Grids represented by even numbers will have samples collected from the center of the sidewall portion of the grid. An exception to this approach is that the sample collected from grid 9 will be collected from the end sidewall of the trench (see figure 3-1). Table 3-1 shows the number and types of regular and quality control samples required for each trench to evaluate attainment of excavation performances standards, and to document the undisturbed boundaries of the excavation.

Because of the hazards associated with entry into steep-sided, unsupported excavations, field personnel will not enter the excavation. Each sample will be collected from the excavation by means of a backhoe/excavator or other equipment. The excavated soil contained in the backhoe bucket will be elevated from inside the trench to the ground surface. Sufficient quantities of soil will be transferred from the bucket to adequately fill the sample containers using a stainless steel spatula, or similar piece of equipment. Soils for volatile organic analysis will be collected directly into the sampling jar to minimize loss of VOCs. Samples will be collected from soils that are not directly in contact with the backhoe/excavator blade.

If the limits of the excavation have not been reached and sampling results indicate that the excavation performance standards specified in the PAM have not been met, then additional excavation will be performed at the direction of the field supervisor. Following the additional excavation, a second phase of excavation boundary sampling will be performed on any grids exceeding the standards stated above. During the second phase of sampling, four samples will be collected from each grid except for the two smaller grids (grids 8 and 9) in which only two samples will be collected. The larger grids will be divided into quarters and the two smaller grids will be divided in half to facilitate a more intensive second phase verification sampling event.

TABLE 3-1 EXCAVATION BOUNDARY SAMPLES PER TRENCH

	Post Excavation Analysis per Trench			
Analysis Method	Excavation Samples	QC Samples per Trench	Total Samples per Trench	Container, Preservation, Holding Time
Total VOAs by Appendix 2 Screening Method (on-site)	16	1 field duplicate	17	4 oz. glass with Teflon liner at 4°C for 14 days
Rinsates Blanks by Appendix 2 Screening Method (on-site)		1	1	2-40 ml glass vial, Teflon-lined septa lid, HCl pH<2, 4°C for 14 days
Total VOAs by SW846 Method 8240/8260 (off-site)		1 split	1	4 oz. glass with Teflon liner at 4°C for 14 days
Trip Blanks by SW846 Method 8240/8260 (off-site)		1/cooler for off-site VOC samples	1	40 ml glass vial, Teflon-lined septa lid, HCl pH<2, 4°C for 14 days
Radiological Screen (@ Building 881) to support off-site shipping requirements		1 per off-site shipment	1	40 ml glass vial, 6 months Note: substitute a 250 ml wide-mouth plastic jar when using a Nomad portable gamma spectroscopy system

3.2 PROCESS VERIFICATION SOIL/DEBRIS SAMPLING

Following TDU treatment of soils and debris, samples will be collected from each batch of treated soil or soil commingled with debris. A batch is defined as the material within a processing run of 6 full TDU treatment ovens. Each oven will contain approximately 5 yd^3 of soil and/or debris. Therefore, a batch will be approximately 30 yd^3. These samples will be collected to document attainment of treatment performance goals as stated in the PAM. Most of the samples collected will be analyzed using the screening technique described in Appendix 2. Additional QC samples (splits) will be collected for analysis using more rigorous SW-846 methods (see Section 3.3).

Process verification soil samples are expected to be collected at two frequencies. Samples will first be collected at a high frequency, to establish baseline conditions of the TDU. If the results of baseline sampling indicate that treatment performance standards are being met (e.g. by evaluating mean and variance values from samples), then the sampling frequency may be reduced.

3.2.1 Sampling Frequency to Establish Baseline Conditions

To establish baseline conditions, samples will be collected at a greater frequency in the initial processing phase of the project. The initial baselining samples will be used to calculate average and variance concentrations of VOCs from each oven during the processing of the first two batches (e.g., 60 yd^3) of treated soil. The samples will be collected at the rate of 1 regular sample per oven on the first two batches of soil to be processed. Assuming that the average and variance values indicate a 95% probability of attaining the post-treatment performance standards, the system will be judged to be in control and samples may then be collected at the reduced frequency established in the following subsection. This determination will be made after the analytical results from the second batch of treated soil are evaluated by the project quality assurance manager and field supervisor. Table 3-2 lists the sample types and frequency to be collected to establish the baseline. The samples used to establish baseline conditions will be collected using the same approach used for collection of samples after baseline conditions have been established. This approach is detailed in the following subsection.

TABLE 3-2 SOIL SAMPLING FOR BASELINE ESTABLISHMENT

	Soil Sampling for Process Verification Baseline Establishment		
Analysis Method	**Process Verification Samples**	**QC Samples**	**Container, Preservation, Holding Time**
Total VOAs by Appendix 2 Screening Method (on-site)	1 per oven per batch	1 field duplicate	4 oz. glass with Teflon liner at 4°C for 14 days
Rinsates Blanks by Appendix 2 Screening Method (on-site)		1	2-40 ml glass vial, Teflon-lined septa lid, HCl pH<2, 4°C for 14 days
Total VOAs by SW846 Method 8240/8260 (off-site)		1 split	4 oz. glass with Teflon liner at 4°C for 14 days
Trip Blanks by SW846 Method 8240/8260 (off-site)		1/cooler for off-site VOC samples	40 ml glass vial, Teflon-lined septa lid, HCl pH<2, 4°C for 14 days
Radiological Screen (@ Building 881) to support off-site sample shipping requirements		1 per off-site shipment	40 ml glass vial, 6 months Note: substitute a 250 ml wide-mouth plastic jar when using a Nomad portable gamma spectroscopy system
Total Expected Number of samples	12 regular samples	1 field duplicate 1 rinsate 1 split 1 trip blank 1 rad screen	

3.2.2 Sampling Frequency After Baseline Conditions are Established

If baseline samples indicate that the treatment process is in control, samples will be collected at a reduced frequency. An evaluation of the confidence level associated with the sampling frequency is given in Appendix 3. This reduced frequency is expected to consist of one representative grab sample per batch, contrasted to one sample per oven as required by the initial baselining evaluation. The number and types of samples expected to be required are described in Table 3-3. A sample will be collected as a grab from a single oven during each batch processing run. During successive batch processing runs, the ovens being sampled will be alternated, so that during 6 runs, all 6 ovens are sampled at least once. The grab sample will be collected from the center (approximate) of the equipment bucket used to unload the TDU ovens. The bucket sampled (sampling position) within the oven will be systematic and representative, in that successive samples will be collected from buckets removing soil from a corner, from a side, and from the center of the ovens. All sample locations within the ovens will be noted in the sampling logbook. Detrimental anomalies in process controls, feed stock composition, and waste type may require additional sampling to determine any effects that the anomalies may have on VOC concentrations in the treated soil.

TABLE 3-3 PROCESS VERIFICATION SOIL SAMPLING

	Process Verification Soil Sampling		
Analysis Method	**Process Verification Samples**	**QC Samples per 20 Batches**	**Container, Preservation, Holding Time**
Total VOAs by Appendix 2 Screening Method (on-site)	1 per batch	1 field duplicate	4 oz. glass with Teflon liner at 4°C for 14 days
Rinsates Blanks by Appendix 2 Screening Method (on-site)		1	2-40 ml glass vial, Teflon-lined septa lid, HCl pH<2, 4°C for 14 days
Total VOAs by SW846 Method 8240/8260 (off-site)		1 split	4 oz. glass with Teflon liner at 4°C for 14 days
Trip Blanks by SW846 Method 8240/8260 (off-site)		1/cooler for off-site VOC samples	40 ml glass vial, Teflon-lined septa lid, HCl pH<2, 4°C for 14 days
Radiological Screen (@ Building 881) to support off-site sample shipping requirements		1 per off-site shipment	40 ml glass vial, 6 months Note: substitute a 250 ml wide-mouth plastic jar when using a Nomad portable gamma spectroscopy system
Total Expected Number of samples	100 regular samples	5 field duplicates 5 rinsates 5 splits 5 trip blanks 5 rad screens	

3.3 QC SAMPLING

Because only 16 sampling locations exist in each trench, and QC samples are desired from each trench, one complete set of QC samples will be collected from each trench during the excavation boundary sampling described in Section 3.1. One complete set of QC samples will be collected during the initial TDU process baselining investigation described in Section 3.2.1. Finally, QC samples will be collected at the rate of 1 complete set of QC samples per 20 regular samples during the process verification VOC soil sampling (Section 3.2.2).

All duplicate/split samples will be collected using the same pieces of sampling equipment used for collection of the regular samples. There is no need to decontaminate equipment while collecting regular and QC samples from the same location. The following types of QC samples are being collected to support the T-3 and T-4 remediation:

- Duplicates: Duplicate (collocated) samples will be collected in the same manner and analyzed by the same screening methods, in the same laboratory as the regular grab samples described in Sections 3.1 and 3.2. These samples will be submitted blind to the laboratory.
- Equipment rinsate blanks: These samples will be prepared by collecting distilled water, poured over decontaminated sampling equipment, between collection of regular samples. These blanks will be submitted to the on-site laboratory for screening along with the regular samples. These samples will be preserved to a $pH<2$ with hydrochloric acid (HCl).
- Splits: Splits (triplicates) will be collected in the same manner as the duplicate samples described above. These samples will be sent off-site as a QC check on the internal screening method used for the majority of samples. The split samples will be analyzed under a more stringent analytical protocol (SW846, method 8240/8260, or equivalent), than the screening samples analyzed on-site.
- Trip blanks: A trip blank sample will be shipped with every cooler sent off-site containing samples being analyzed for VOCs. This trip blank will be pre-prepared by the laboratory performing the analysis. The trip blank will be prepared using carbon filtered water and will be preserved to a $pH<2$ with HCl.

All VOC samples sent off-site as QC splits will be analyzed according to the U.S. Environmental Protection Agency's (EPA) SW846 method 8240 or 8260.

3.4 SAMPLES COLLECTED FOR RADIOLOGICAL ANALYSIS

Samples will be collected for radiological analysis to support the following tasks:

- Off-site shipments of samples
- Evaluation of radiological controls for the on-site analytical laboratory (Building 881)
- Determining if radionuclide levels in soils are below the Soil Action Levels currently being developed by the RFCA Working Group.

3.4.1 Radiological Screening Samples

A radiological screening sample will be taken whenever samples are being collected for off-site analysis. These samples will be analyzed for gross alpha/beta in Building 881. Results of these samples will be used to evaluate shipping requirements. In addition, at the discretion of Building 881 laboratory management and radiological engineering personnel, additional radiological screening samples may be collected for internal laboratory monitoring purposes. An interoffice memorandum prepared by Building 881 Radiological Engineering personnel (AEM-025-96) suggests collection of radiological screening samples at the following rate:

- One radiological screen per day during the first week of TDU processing and laboratory analysis.
- One radiological screen per week, thereafter.

Radiological Engineering personnel require that samples be collected randomly and that results are reported to Radiological Engineering, as the individual analysis is completed.

At the discretion of the field supervisor, samples analysis using a high purity germanium gamma spectroscopy (HPGE) system may substitute for radiological screens. This HPGE analysis is described in the following subsection.

3.4.2 Radiological Verification of Soils Returned to the Excavation

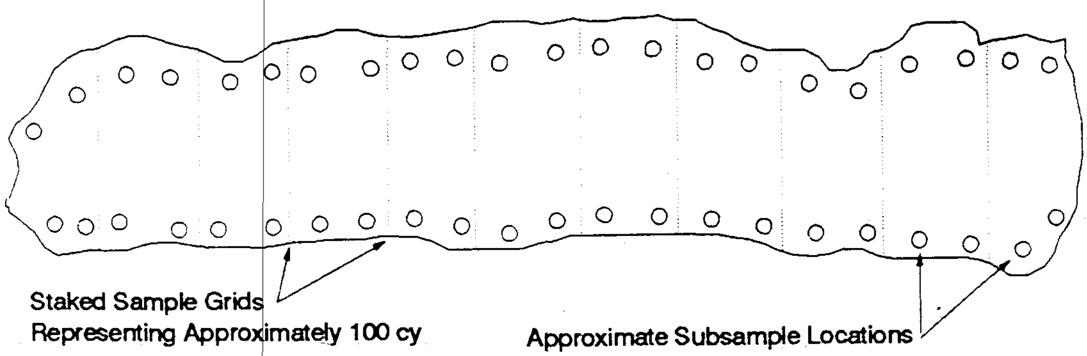
As soils are being excavated from the trenches they will be screened with a Field Instrument for the Detection of Low Energy Radiation (FIDLER). The determination of what to screen will be based on visual characteristics indicative of contamination such as staining, metallic debris, free product and direction given by Radiological Engineering. Any material indicating screening values exceeding 3 times background will be segregated and may require additional, more detailed (on a volume basis), isotopic characterization, than soils having screening values less than 3 times background. This determination will be made by Radiological Engineering, and will be documented in the field logbook.

Soils indicating FIDLER readings less than three times background will be sampled for isotopic characterization, after the soils are treated. Only those treated soils that are at or below the agreed-on replacement levels for radionuclides (put-back levels) for subsurface soils will be returned to the trench. These action levels are currently being developed by the RFCA Working Group and will be available for use by the project this summer.

Following treatment of soils in the TDU, the soils indicating radiological screening values less than 3 times background screen will be stockpiled in the treated soil staging area. The stockpile is expected to be divided into equal volume grids representing approximately 100 yd^3 /grid. Stakes, or equivalent marking devices, will be used to denote sampling grids. The stockpile is expected to be divided as represented by Figure 3-2. One composite sample will be collected from each 100 yd^3 grid volume. The composite sample will be made up of 4 subsample grabs collected from near the "corners" of the staked out sampling grids, as represented by Figure 3-2. Each subsample will be approximately the same volume and will be collected from the surface of the stockpile with a scoop or similar device. There is no need to decontaminate the scoop between subsample locations, however decontamination will be required when sampling between grids.

Samples collected to verify that the radiological parameters stated above are not exceeded will be analyzed using a HPGE system. This HPGE analysis is expected to take place in the field using Radiological Engineering Procedure 14.01, Operation of the Nomad Portable Gamma Spectroscopy System. Samples will be collected in 250 ml wide-mouth plastic jars which the Nomad System is calibrated for.

Figure 3-2 Stockpile and Sampling Layout for Radiological Verification Samples



3.5 DEBRIS SAMPLING

A significant amount of characterization data exists for the soils in T-3 and T-4. However, very little information exists regarding volume, type, and chemical characterization of the debris within the trenches. The possibility exists that some of the debris is not contaminated with VOCs. As the excavation proceeds, if it appears from field organic vapor screening and visual observations that much of the debris is not contaminated, then per RFETS waste management policies, efforts will be made to segregate this apparently "clean" debris from the debris which is obviously contaminated with VOCs. Segregated debris, thought to be "clean" would then be more rigorously sampled to evaluate if it is contaminated with VOCs above hazardous waste standards. If the debris exceeds VOC hazardous waste standards, it will be treated. If sampling results indicate that VOC hazardous waste standards were not exceeded, then the debris would not require processing in the TDU. This evaluation process is described in the following subsections.

3.5.1 Initial VOC Evaluation

As the debris is removed from the excavation, the field supervisor will have the option to segregate the debris into two basic waste types. One waste type will be debris that is obviously contaminated with VOCs, or in which a representative sample could not be collected to assure the debris is VOC free. This debris pile will be processed in the TDU.

Another waste type will consist of debris that is not expected to contain significant VOC contamination. Depending on field conditions and field supervisor judgement, this wastestream may be further segregated by the type of debris. For instance, if various types of debris wastestreams (e.g., crushed drums, asphalt planking, and/or construction materials) are excavated, they may be segregated by type to assist in the collection of representative samples. The criteria used to **initially** segregate the waste as potentially VOC free, will be:

- No organic vapor detections above background using industrial hygiene monitoring equipment.
- No visible evidence of contaminant staining.
- Based on the field supervisor's professional judgement, considering location within the trench, closeness to other VOC free debris, and a likelihood that the debris in question would be VOC free.

3.5.2 Sampling Potentially VOC Free Debris

Debris which the field supervisor believes to be VOC free will be sampled for verification. Efforts will be made to segregate this waste stream by type (i.e., asphalt planking or construction rubble). Furthermore, to minimize sampling costs, efforts will be made to accumulate sufficient volume for a single sample per potential shipment volume, such as one sample per 20 yd^3. The 20 yd^3 volume is representative of the volume of a typical roll-off container used for off-site waste shipments.

Each sample will be made up of various subsample grabs. The collection of these subsample grabs must spatially represent the material being characterized. The sample container will be opened only when adding the subsample grabs. This sample will be analyzed for VOCs using a total concentration (either the screening method listed in Appendix 2 or SW-846 Method 8240/8260). If the individual total VOC concentrations are at levels which could not exceed a characteristic hazardous waste standard as defined in 6 Code of Colorado Regulations (CCR) 1007-3, Section 261.24, then the debris would not be considered hazardous for VOCs. This evaluation will be based on the commonly accepted "20 times rule" in which the total concentration is divided by 20 and compared to the toxicity characteristic leaching procedure (TCLP) standards specified in the regulation stated above. Due to dilutions in the analytical methods, total concentrations in soils (measured in mg/kg) which are less than 20 times the TCLP standards (measured in mg/L) are accepted not to exceed the actual TCLP standards. Debris exceeding these standards would be processed in the TDU unit.

3.5.3 Sampling After Treating Debris

After debris is processed in the TDU, the debris itself will not be sampled to show attainment of performance goals. Rather, in accordance with EPA guidance, samples will be collected from soil residues commingled with the processed debris. These soil "residues" will be analyzed for total VOCs using either the screening method listed in Appendix 2 or SW-846 Method 8240/8260. These samples will be collected from commingled soil which is expected to be "caked on" to some of the debris. Sample results will be evaluated against the VOC action levels listed in 6 CCR 1007-3, Section 261.24 (the TCLP standards), to support proper disposition of the waste.

3.5.4 Sampling of Debris for Other than VOCs

A hazardous waste determination will be required for all debris. In some instances, this determination may be able to be made without the need for the collection of additional samples, based on the type of debris, and its prior use before becoming a waste. However, in other situations, information will not be available to make a determination without the aid of appropriate analytical results. Therefore, flexibility will be given to the field supervisor in making these determinations. It is expected that the field supervisor will work with the RFETS Waste Management Organization in determining analysis requirements (other than for VOCs) for debris slated for off-site disposal. Any additional sampling will be fully documented in the sample logbook.

4.0 SAMPLE DESIGNATION

The site standard sample numbering system will be utilized for this project. Each sample will be assigned a unique nine digit number. The first two digits will be either a TR (trench) for the excavation boundary samples, or a PV (process verification) for the process verification soil samples. All debris and radiological verification samples will be collected using the "PV" designation as the first two digits of the sample number. The next five digits in the sample number will be sequential numbers representing the individual samples. The last two digits of the sample number will be RM, representing the company responsible for the sampling.

5.0 SAMPLING EQUIPMENT AND PROCEDURES

This FSP lists the procedures used to conduct the sampling program, and the procedures list the required task specific sampling equipment. If conditions are encountered in the field which make the use of a procedure unsafe or inappropriate for the task at hand, the procedures specified below may be modified or replaced as long as the modification or replacement procedure is detailed in the field logbook and the justification for its use is explicitly stated.

5.1 SAMPLE HANDLING AND PROCEDURES

Samples collected for laboratory analysis will follow *Environmental Management Department (EMD) Operating Procedures Volume I Field Operations 5-21000-OPS-FO.13, Containerization, Preserving, Handling, and Shipping of Soil and Water Samples*. All water samples will be collected without the use of filters. Packaging of samples in paint cans required by the procedure for medium level samples (e.g., samples with VOC concentration above 10 ppm) will not be adhered to for this project. Other modifications to the procedure include:

Section 6.2, page 8: The outside of sample containers will be wiped clean. Due to the rapid nature of the collection and submittal of samples, the samples will be placed in coolers with blue ice and/or transferred to on-site refrigeration as soon as possible. However, it is recognized that samples collected out of the TDU ovens will be warm, and that the cooler temperature will not be able to be maintained at 4° C. In addition, because the samples may be carried directly to the on-site laboratory for analysis they may still be warm.

Section 6.5, page 14: Samples will not be placed in plastic bags.

When reusable sampling equipment is used, the equipment will be decontaminated in accordance with EMD Operating Procedure 5-21000-OPS-FO.03, *General Equipment Decontamination, Section 5.3, Cleaning Procedures for Stainless Steel or Metal Sampling Equipment*.

5.2 DOCUMENTATION

Samples collected for other than field screening will follow the requirements of 5-21000-OPS-FO.14, *Field Data Management*, and 3-21000-ADM-17.01 *Quality Assurance Records*

Requirements. These procedures will ensure that data is collected, entered, and stored in a secure, controlled, and retrievable environment. For this project, the following modifications to the procedure are being made to ensure efficient data documentation:

Section 6.4, Item [2]: Chain of Custody (COC) forms will be copied to the RFEDS group after the samples are relinquished to the laboratory.

Section 9, Note: Field information and sample event data will transmitted to RFEDS as soon as possible or at the end of the project.

Section 10 [2] Computers will be backed up monthly.

After entry into the interim database, Datacap, the data will be uploaded to the Rocky Flats Environmental Database System (RFEDS) database.

Field instrument data sheets, field logbooks, and sample collection forms will include the following information for each data or sample point:

- Field sample identification;
- Date and time of sampling or measurement;
- Sample location;
- Sample description;
- Sample depth (if appropriate);
- Parameters or analyses being reported;
- Associated field QA /QC samples;
- Field measurements made by field instruments;
- Equipment model and serial numbers with latest calibration date where applicable; and
- Background readings and measurement units.

Trench and process verification soil sample information will be recorded on forms prepared for this project for entry into Datacap. These forms will be reviewed by the Project Manager, or designee, prior to data entry into Datacap. A hard copy of the manually entered data will be initialed and dated by the Project Manager, or designee and the Data Manager. Data will be checked for transcription errors, accuracy, and to ensure that all samples that were intended to be collected were collected, shipped and entered into Datacap.

Changes or corrections may be required in the data stored in Datacap. All changes must be accompanied by a data correction/change form. The form will detail the changes to be made and document that the changes were completed. Corrections to the database will be reviewed by the Data Manager or designee for potential entry errors.

The following actions are designed to ensure the final data submitted to RFEDS is complete, correct, and consistent with procedure FO.14, *Field Data Management*.

- A hard copy of the data organized by location will be verified by the Data Manager or designee.
- All corrections to the hard copy will be made in red ink.
- Using the data entry sheets and sample collection sheets, the information will be checked to assure that data identifications are correctly listed on the hard copy, and the number of samples collected and shipped is correct.
- Check that all the parameters requested for each analysis are reported on the hard copy, and that units reported on the hard copy are correct.
- Check values for all manually collected parameters reported from the database against the field collection forms.
- The data will be reviewed by project personnel familiar with the project objectives and data collection activity to disposition data containing gross errors.
- Check the corrected copy of the database to determine that corrections have been implemented.

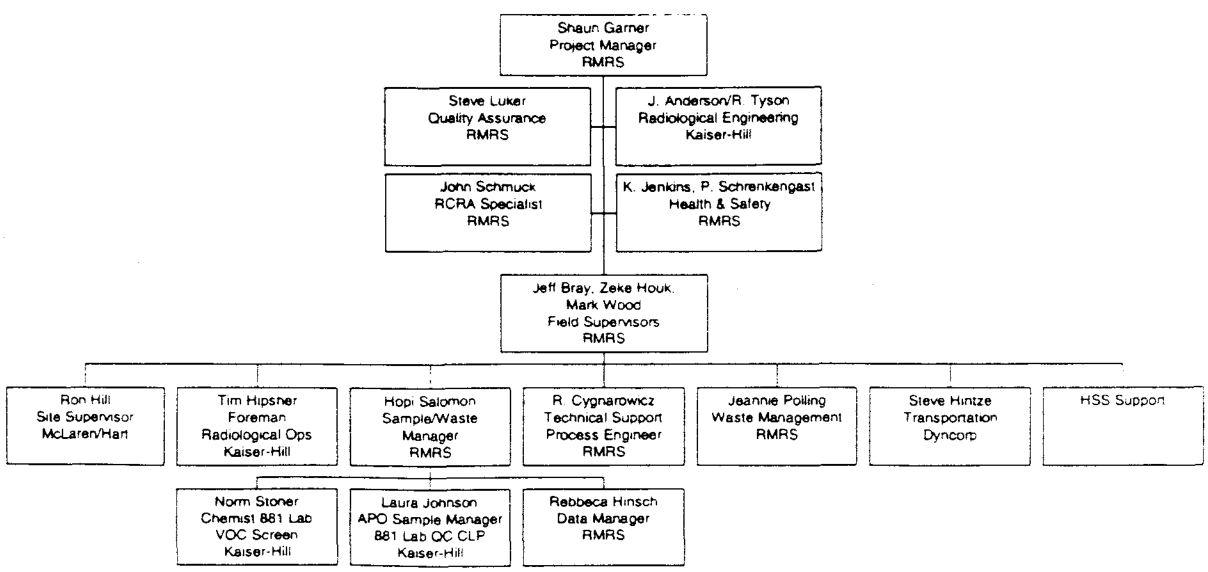
6.0 PROJECT ORGANIZATION

Figure 6-1 represents the organization structure for this project. The Project Manager is responsible for ensuring that all data are collected, verified, transmitted and stored in a manner consistent with relevant operating procedures. The Project Manager, or designee, will obtain from the RFEDS as directed by the Analytical Projects Office (APO), sample numbers and location codes. The User System Manager will verify any transmitted record for accuracy and completeness and ensure the data is preserved, retrievable, and traceable.

The sample crew personnel will be responsible for field data collection. Their data management tasks will include completing all appropriate data management forms and completing the chain-of-custody form. The sample crew will deliver screening samples destined for on-site analysis with completed chains-of custody to personnel in the 881 lab, where the chemist or sample receiving personnel will sign for receipt of the samples. QC samples being sent off-site for analysis will be coordinated through APO personnel.

The Sample Manager/Data Manager is responsible for verifying that the chains-of-custody are complete and accurate before the samples are shipped to the laboratory. The Data Manager's duties include data entry into Datacap, and transmitting field information, sample collection data, and chain-of-custody tracking data to RFEDS. All QA records for the analytical portion of this project will be stored in the APO.

Figure 6-1 T-3/T-4 Project Organizational Structure



7.0 REFERENCES

RMRS, 1995. Quality Assurance Program Plan (QAPP). 95-QAPP-001. Golden, Colorado. October 1995.

RMRS, 1996. Proposed Action Memorandum for the Source Removal at Trenches T-3 and T-4 (IHSSs 110 and 111.1). Revision 2. March 1996.

RMRS, 1996. Field Implementation Plan for Trenches T-3 and T-4 Source Removal. Draft. April 1996.

United States Environmental Protection Agency, 1991. USA EPA-CLP Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration. Document number OLM 01.1, Rev. OLM 01.8. August 1991.

Appendix 1

Summary of Existing Analytical Data for T-3 and T-4

TABLE A1-1
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-3

Analyte	Background Mean plus 2 Standard Deviations(5)	Number of Samples	Number of Detections(4)	Percent Detections	Concentration or Activity Range(1)
Volatile Organic Compounds (mg/kg)(5)					
1,1,1-Trichloroethane	NA	36.4	8	36.4	0.006-27(J)
Acetone	NA	21	8	38.1	0.036-5100(B)
Carbon tetrachloride	NA	22	10	45.5	0.004(J)-700
Chloroform	NA	22	6	27.3	0.001(J)-8.8
Ethylbenzene	NA	22	1.00	4.5	0.009
Methylene chloride	NA	22	16	72.7	0.003(J)-2400(B)
Tetrachloroethene	NA	22	20	90.9	0.002(J)-13,000(D)
Toluene	NA	22	13	59.1	0.022-7.6(J)
Trichloroethene	NA	22	5	22.7	0.002(J)-120

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics
indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.

(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.

(3) Radionuclide activities less than or equal to zero are considered to be non-detections.

(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.

(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE A1-1 (continued)
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-3

Analyte	Background Mean plus 2 Standard Deviations(5)	Number of Samples	Number of Detections(4)	Percent Detections	Concentration or Activity Range(1)
Semivolatile Organic Compounds (mg/kg)(5)					
2-Methylnaphthalene	NA	12	2	16.7	8.0(E)-9.3(E)
2-Methylphenol	NA	12	2	16.7	0.45-0.5(DJ)
4-Methylphenol	NA	12	2	16.7	2.9-3.6(D)
Bis(2-ethylhexyl)phthalate	NA	11	9	81.8	0.051(J)-6.3(D)
Di-n-butyl phthalate	NA	12	2	16.7	1.3-1.7(D)
Hexachlorobutadiene	NA	12	1	8.3	0.17(J)
Hexachloroethane	NA	12	2	16.7	0.37-1.1
Naphthalene	NA	12	2	16.7	0.96-2
Phenanthrene	NA	12	2	16.7	2.5-2.7

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics
indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE A1-1 (continued)
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-3

Analyte	Background Mean plus 2 Standard Deviations	Number of Samples	Number of Detections(4)	Percent Detections	Concentration or Activity Range(1)
PCOC Metals above background (mg/kg)(2)					
Arsenic	13.2	11	11	100	1.4(B)-9.2(B)
Barium	289	11	11	100	21.9(B)-251
Cadmium	1.7	11	4	36.4	0.74-0.88
Lead	24.9	11	11	100	3.1-86.4
Manganese	901.6	11	11	100	1.3(B)-1440(B)
Silver	24.6	11	7	63.6	96.50

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics
indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE A1-1 (continued)
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-3

Analyte	Background Mean plus 2 Standard Deviations	Number of Samples	Number of Detections[4]	Percent Detections	Concentration or Activity Range[1]
PCOC Radionuclides above background (pCi/g)[2][3]					
Americium-241	0.012	12	12	100	0.0007-0.598
Plutonium-239/240	0.018	12	12	100	0.009-3.12
Strontium-89/90	0.747	12	9	75	0.008[J]-0.748[J]
Tritium (pCi/l)	395.211	12	12	100	0.536-333[J]
Uranium-233/234	2.643	12	12	100	0.551-14.4
Uranium-235	0.114	12	12	100	0.0097[J]-0.751
Uranium-238	1.485	12	12	100	0.628-26.4

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE A1-2
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-4

Analyte	Background Mean plus 2 Standard Deviations	Number of Samples	Number of Detections[4]	Percent Detections	Concentration or Activity Range[1]
Volatile Organic Compounds (mg/kg)[5]					
1,1,1-Trichloroethane	NA	18	4	22.2	0.002(J)-2.3(E)
1,1-Dichloroethene	NA	18	1	5.6	0.009
Acetone	NA	18	3	16.7	0.026(J)-120
Carbon tetrachloride	NA	18	1	5.6	0.35(E)
Chloroform	NA	18	2	11.1	0.004(J)-0.77(E)
Ethylbenzene	NA	18	3	16.7	0.012-0.87(D,J)
Methylene chloride	NA	18	3	16.7	0.19(BJ)-8.2(B,J)
Tetrachloroethene	NA	18	11	61.1	0.001(J)-37
Toluene	NA	18	10	55.6	0.003(J)-0.67(J)
Trichloroethene	NA	18	8	44.4	0.02-680

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics
indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE A1-2 (continued)
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-4

Analyte	Background Mean plus 2 Standard Deviations(5)	Number of Samples	Number of Detections(4)	Percent Detections	Concentration or Activity Range(1)
Semivolatile Organic Compounds (mg/kg)(5)					
2-Methylnaphthalene	NA	16	3	18.8	0.051(J)-0.29(J)
Bis(2-ethylhexyl)phthalate	NA	16	8	50.0	0.038(J)-0.76(B)
Naphthalene	NA	16	2	12.5	0.052(J)-0.15(J)
Phenanthrene	NA	16	4	25.0	0.13(J)-.57

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics
indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE A1-2 (continued)
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-4

Analyte	Background Mean plus 2 Standard Deviations	Number of Samples	Number of Detections[4]	Percent Detections	Concentration or Activity Range[1]
PCOC Metals above background (mg/kg)[3]					
Arsenic	13.2	16	15	93.8	3.6-11.5
Barium	289	16	16	100	34.4-153
Cadmium	1.7	12	6	50.0	0.35(B)-10.5
Lead	24.9	16	16	100	3.6-59.5
Manganese	901.6	16	16	100	66.5-944
Silver	24.6	14	10	71.4	0.91(B)-68.5

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics
indicates analyte was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

TABLE A1-2 (continued)
ANALYTES DETECTED IN SUBSURFACE SOILS AT TRENCH T-4

Analyte	Background Mean plus 2 Standard Deviations	Number of Samples	Number of Detections(4)	Percent Detections	Concentration or Activity Range(1)
PCOC Radionuclides above background (pCi/g)(2)(3)					
Americium-241	0.012	16	16	100	0.002(J)-5.91
Plutonium-239/240	0.018	16	16	100	0.003(J)-16.6
Strontium-89/90	0.747	10	10	100	0.002(J)-0.586(J)
Tritium (pCi/l)	395.211	10	10	100	57.8(J)-211(J)
Uranium-233/234	2.643	16	16	100.00	0.449-191.7
Uranium-235	0.114	16	16	100	0.008(J)-11.5
Uranium-238	1.485	16	16	100.00	0.543-113.1

(1) In this column, the J qualifier represents estimated results, the D qualifier represents dilution results, the B qualifier for organics indicates analyte
was detected in blank sample, and the B qualifier for metals represents estimated result.
(2) For metals and radionuclides, only potential chemicals of concern (PCOCs) were reviewed and presented in this table.
(3) Radionuclide activities less than or equal to zero are considered to be non-detections.
(4) Radionuclide and metal results less than the background mean plus two standard deviations are considered to be non-detections.
(5) Background concentrations do not exist and are not applicable for organic compounds.

Appendix 2

T-3 & T-4 Volatile Screen QA/QC Requirements

The scope of this method is to outline the QA/QC requirements for VOC screening of soil and water samples obtained in support of the T-3/T-4 excavation and soil treatment. The procedures from which this method was derived are described in detail in SW-846 Methods 8240 and 8260, and the CLP SOW. Due to the rapid time constraints for screening samples, laboratory control samples and full CLP data packages are not required for this project. Data Quality Objectives allow samples to be analyzed at levels comparable to the action levels required for the project. Low detection limits are not required for this project, and would prohibit the rapid analysis required to evaluate soil treatment. Split samples are expected to be sent to an independent laboratory for verification of the analytical results. The split samples will be analyzed under methods capable of being fully validated.

Screening Method

Holding Times:
Samples shall be analyzed within 14 days of sampling. The soil samples will be analyzed on the same day they are extracted with Purge and Trap grade Methanol. The nature of this project requires next-day/same-day reporting, and holding times should not be exceeded.

Preparation:
The soil samples will be analyzed as Medium Level Soils. This procedure includes extraction of 4 grams of the soil into 10 mL methanol, and purging up to 100 uL of this extract in a 5 mL sparge volume. The samples will not require percent moisture determinations, and will be reported on an "as received" basis. The field/equipment rinsate samples will not be prepared, and will be analyzed at 5 mL.

Initial and Daily Calibrations:
A bromofluorobenzene (BFB) tune will be performed prior to the initial calibration. A three or five point initial calibration to determine linear range will be performed prior to analysis of samples. Practical Quantitation Limits (PQLs) provided in SW-846 and the CLP SOW are referenced and required to meet the action levels for this project. The requested linear range is approximately 0.6 mg/Kg to 25 mg/Kg. This initial calibration will also be used for the rinsate sample with the requested linear range of 5 ug/L to 200 ug/L. This initial calibration will be used to compare daily calibrations, and will be of methanol extract matrix (100 uL equivalent of methanol in each standard).
A BFB tune followed by the daily calibration standard will be evaluated each day or 12 hours, which ever is more frequent during sample analysis. A mid-level methanol matrix standard will be used for quantitation purposes, and daily calibrations. All calibrations will be compared to CLP or SW-846 calibration requirements for acceptability. Calibrations shall include, at a minimum, all target analytes required for quantitation. Surrogates and internal standards shall be used in all analyses.

Blanks:
A method blank of methanol matrix (100 uL methanol) shall be analyzed daily, or every 20 samples, which ever is more frequent, during sample analysis. The blank shall be analyzed after the initial or daily calibration, and prior to sample analysis. Blank subtraction is not permissible. All analytes present in the blank will be reported. A water matrix blank will be analyzed for the rinsate sample.

Surrogates and Internal Standards:
Surrogates and internal standards shall be used in all analyses. Surrogate recoveries will be compared to CLP or SW-846 requirements. Internal standard areas shall be within -50% to +100% of the mid level standard of the day.

Matrix Spikes/Laboratory Control Samples:
Matrix spikes/laboratory control samples are not required for screen samples.

Tentatively Identified Compounds (TICs):
TICs are not required for screen samples. Electronic data shall be maintained so that TICs may be retrieved at a later date.

Retention Times:
Retention times shall be monitored for shifts. Corrective action is required for shifts greater than 30 seconds from the daily calibration or mid-level initial calibration performed the day of sample analysis.

Dilutions:
Dilutions should not be required for screen samples. If the sample exceeds the linear range, the Project Manager will be notified immediately, and a result of greater than the upper linear range will be reported for the sample. If dilutions are requested by the Project Manager, serial dilutions shall be performed.

Forms:
CLP or equivalent forms are requested. Faxed Form I of the blank and samples are required. Full CLP data packages are not required.

Target Compounds for T-3/T-4 Remediation Project:
The following list of VOCs, are the essential target compounds used to evaluate the attainment of both excavation performance and processing performance.

Contaminant	Excavation Cleanup Standard (ppm)	PAM Required TDU Performance Standards (ppm)	Subcontractor Required TDU Performance Standard (ppm)
1,1,1-TCA	378	6.0	2
1,1-DCE	11.9	6.0	2
1,2-DCA	6.33	6.0	-
1,2-DCE	9.51	-	-
Benzene	-	10	-
Acetone	-	160	80
Carbon tetrachloride	11	6.0	2
Chloroform	152	6.0	2
Ethylbenzene	1760	10	2
Methylene chloride	-	30	15
PCE	11.5	6.0	2
Toluene	2040	10	2
TCE	9.27	6.0	2

Sequence of Analyses:

A. Analyzing Initial Calibration:
1. BFB
2. Initial Calibration--analyzed at start of project and repeated only as necessary.

B. Analyzing samples immediately after initial calibration:
1. BFB
2. Initial Calibration--analyzed at start of project and repeated only as necessary.
3. Blank
4. Samples

C. Daily Analysis:
1. BFB
2. Daily Calibration--comparison to initial calibration performed previously
3. Blank
4. Samples

Appendix 3

Optimizing the Number of VOC Samples Collected from Baseline Processing

Given adequate process control, the number of samples required to be collected through the thermal desorption remediation process is a function of the performance of the TDU. The lower the mean value of remaining VOC concentrations within the soils (as established by the initial baselining processing runs), the fewer samples required after the baseline has been established. Conversely, the higher the mean value of remaining VOC concentrations during baselining, the more samples required after baselining. An example of the type curve used for establishing the number of samples is given in Figure A3-1. As the figure indicates, if the mean VOC concentration of concern (e.g., PCE) is 3 mg/kg, than 3 samples will be required per batch for a 95% confidence. If the mean concentration is 2 mg/kg, then one sample will be required per batch. Assuming, that baseline sampling will establish a mean concentration of 2 mg/kg or less, one sample would be collected per batch after baseline conditions have been established.

Figure A3-1 Type Curve for the Number of After-Process Verification VOC Samples Required After Baseline Conditions Have Been Established

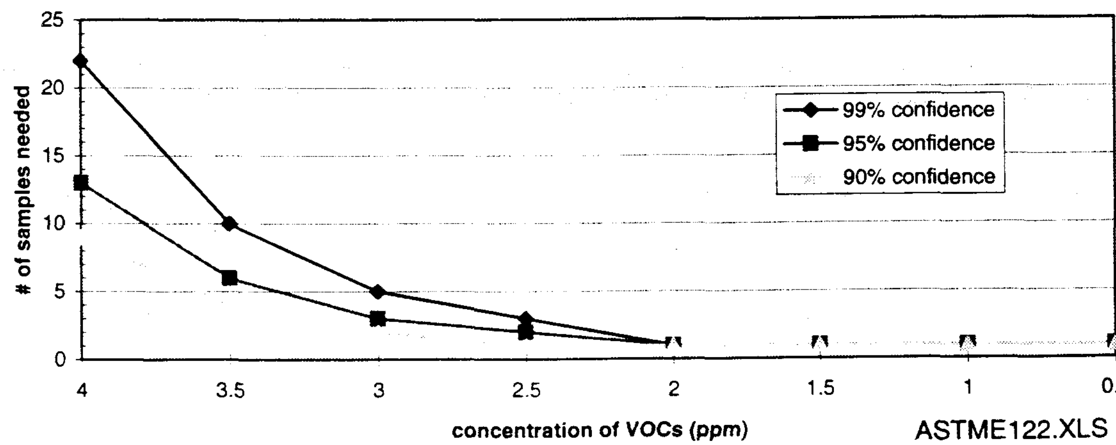


Figure A3-1 was derived by using equations from ASTM (1979[1]). A standard deviation of 67% of the mean VOC concentration was assumed (consistent with a normal distribution of data), while the maximum error allowable was set to insure that the average concentrations of limiting VOCs would not exceed regulatory thresholds (in the T-3/T-4 case, 6 mg/kg for limiting VOCs). Calculations were performed at several potential concentrations, and at several confidence levels, as seen by the data points on the type-curves. A confidence of 95% or better will be achieved by using these curves to select the number of samples from a "batch" of soil.

References for statistical analysis:

[1]ASTM E 122 - 72, 1979. "Standard Recommended Practice for Choice of Sample Size to Estimate the Average Quality of a Lot or Process".

Appendix 4
Radiological Evaluation of T-3 and T-4 Soils

Several different methods were used to determine the optimum number of samples needed to adequately estimate an average value for radioisotopes of concern within the T-3/T-4 soils. The radioisotopes are $^{239/240}Pu$, ^{241}Am, $^{233/234}U$, ^{235}U, and ^{238}U. Based on the radionuclide concentrations in soil and liquid samples already taken from the trenches, the number of samples needed to estimate an average value is well below the number of samples that have already been collected. Estimates as presented in this appendix were calculated with a 95 percent confidence or better that the true mean value of radionuclides is less than the proposed preliminary remediation goal [PPRG]. Typically, a confidence of 95% or greater is adequate for decision-making with respect to environmental and risk assessment scenarios[2]. Table A4-1 provides the results of the statistical analyses of radionuclide concentrations in the T-3/T-4 soils. The second column of the table presents the number of samples already taken (the number of T-3 samples is conservative, as investigation derived materials within drums are not included). Based on statistical analysis of the data represented by the samples already collected, the fourth through seventh columns indicate the number of samples needed (calculated) based on the types of methods noted in the column header, and as further defined in the reference section at the end of this Appendix. The number of samples needed are rounded up to the nearest whole number. The tenth and eleventh columns indicate the upper confidence limits (UCLs) for average radionuclide concentrations, and the last column contains the PPRGs for a construction worker in subsurface soils.

Given the number of samples already collected, which is greater than the number needed (calculated) for acceptable confidence in the decision, the UCL, at the 95% level for all radionuclides also indicates concentrations well below the PPRGs and the action levels currently being developed by the RFCA Working Group. The only exception is ^{238}U, which exceeds the PPRG value of 60 pCi/g by 3 pCi/g. It should be noted that this ^{238}U activity is still far below the present Rocky Flats Cleanup Agreement (RFCA) draft Soil Action Levels for ^{238}U of 543.9 pCi/g using a direct exposure to surficial soils in a residential scenario.

Table A4-1 Statistical Analysis of Radionuclide Concentrations in T-3/T-4 Soils

column 1	column 2	column 3	column 4	column 5	column 6	column 7	column 8	column 9	column 10	column 11	column 12	column 13
					log-trans							
				t-statistic	t-statistic	EPA						
T3 Trench			ASTM	(Gilbert)	(Gilbert)	DEFT			normal	lognormal		
rad type	# samples		samples	samples	samples	samples			UCL 95%	UCL 95%		PPRGs
	ACTUAL		NEEDED	NEEDED	NEEDED	NEEDED			(pCi/g)	(pCi/g)		(pCi/g)
Pu 239/40	10		1	1	2	3			0.70	3.29		219
Am 241	10		1	1	1	3 (est)			0.15	0.50		164
U 233/4	10		1	1	1	3 (est)			2.83	4.04		1546
U 235	10		1	1	1	3 (est)			0.36	0.39		12.5
U 238	10		1	1	2	4			6.84	18.65		60.1
					log-trans							
				t-statistic	t-statistic	EPA						
T4 Trench			ASTM	(Gilbert)	(Gilbert)	DEFT			normal	lognormal		
rad type	# samples		samples	samples	samples	samples			UCL 95%	UCL 95%		PPRGs
	ACTUAL		NEEDED	NEEDED	NEEDED	NEEDED			(pCi/g)	(pCi/g)		(pCi/g)
Pu 239/40	8		1	1	3	3 (est)			0.83	56.24		219
Am 241	8		1	1	3	3			-0.38	5.96		164
U 233/4	8		1	1	1	3 (est)			2.42	38.97		1546
U 235	8		1	1	4	3			0.25	1.61		12.5
U 238	**8**		**7**	**6**	**4**	**8**			**3.04**	**63.31**		**60.1**

T3RADSL5.XLS

Notwithstanding the statistical confidences derived above, the subjective uncertainty associated with potential "hotspots" in the trench (missed in prior sampling) are compelling enough to warrant limited sampling of soils AFTER excavation and BEFORE returning the treated soils to their respective trenches.

Soils will be monitored for radionuclides with a FIDLER during the excavation and periodically during the treatment per Radiological Operating Instruction (ROI) - 6.6, Operation of the Bicron FIDLER. The volumes of material so screened will be based on a graded approach. Material with the greatest chance of being radiologically contaminated (e.g., soil commingled with debris, or having visual characteristics such as staining) will be screened more rigorously than soils that do not appear to be contaminated.

So that additional radiological controls can be evaluated and put in place, soil that exhibits readings greater than three times ambient background will be segregated from the other material. Three times ambient background correlates to approximately 6600 counts on the FIDLER detector. This FIDLER screening value was obtained by making very conservative assumptions regarding the isotopes present in the soil and their associated ratios. The assumptions are given below:

- ^{235}U is 0.7% of the total uranium isotope present
- ^{241}Am ingrowth is 18% of the total value of ^{239}Pu. This is based on a thirty year age of plutonium.
- FIDLER correction factor is 12 pCi/g, per 100 corrected counts. The three times background would then convert to approximately 800 pCi/g total activity.
- Since the most limiting put-back values are for ^{235}U and ^{241}Am, all indicated activity on the FIDLER is assigned to plutonium and then to uranium and the values for ^{241}Am are calculated. This process assumes the worst case scenario and calculates the highest possible values for these two limiting isotopes.

Soils having FIDLER readings less than three times background will be sampled for isotopic characterization at the rate of approximately 1 composite sample per 100 yd^3, after the soils are treated. Any segregated material (soils having radionuclide content greater than three time background) may require additional, more detailed (on a volume basis), isotopic characterization, than soils having screening values < 3 time background. This determination will be made by Radiological Engineering, and will be documented in the field logbook.

The isotopic characterization will be performed using a high purity germanium gamma spectroscopy system per Radiological Engineering Procedure 14.01, Operation of the Nomad Portable Gamma Spectroscopy System. This system will provide quantitative analysis of the radioisotopes, and will provide confirmation that Soil Action Levels being developed by the RFCA Working Group have not been exceeded.

References for statistical analysis:

[1]ASTM E 122 - 72, 1979. "Standard Recommended Practice for Choice of Sample Size to Estimate the Average Quality of a Lot or Process".

[2]DOE, 5/95. "Phase II RFI/RI Report 903 Pad, Mound, and East Trenches Area, Operable Unit 2", Vol. 15, Appdx H, Baseline Health Risk Assessment, Rocky Flats Environmental Technology Site, Golden, CO

[3]EPA QA/G-4, 1994. "Guidance for Planning for Data Collection in Support of Environmental Decision Making Using the Data Quality Objective Process", Interim Final

[4]Gilbert, R.O., 1978. Statistical Methods for Environmental Pollution Monitoring", Van Nostrand Reinhold, New York